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Community engagement for irrigation water management in Lao PDR

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Abstract

Sustainable water resources management and community engagement are essential for water security. Referring to the above context, this study proposed to carry out an assessment of community engagement for irrigation water management in the Nam Haad Left Irrigation Project (NHLIP). The household and community level practices and the farmers' levels of participation in irrigation water management of the NHLIP were carefully considered. From respondents' responses, the results revealed that a husband-wife partnership plays a remarkable role in irrigation water management of the NHLIP for rice farming. The results also proved that most of the respondents engage with a high participation level in managing irrigation water of the NHLIP project as illustrated by a high score of 3.80 on the five-point Likert scale. To determine the significance of each activity on farmers' levels of participation in irrigation water management of the NHLIP, a stepwise multiple regression analysis was employed and the standardized regression equation for determining overall participation levels can be presented as: $Y = 0.538x_1 + 0.831x_8 + 0.534x_{14} + 0.607x_{18} + 7.572$. Finally, the outcomes of this study indicated the willingness of participation in cooperating and supporting the activities related to the improvement and management of the NHLIP project.

Key words: *community involvement, irrigation management, Statistical Package for Social Sciences (SPSS), stepwise multiple regression, Water User Group*

INTRODUCTION

Lao PDR is known as a land-locked country, which significantly relies on natural resources and its agricultural productivity. Based on the report published by the Ministry of Agriculture and Forestry (MAF) in 2013, it stated that numerous efforts have been put in place to support and alleviate the poverty of the rice farmers and also to promote the development of agricultural sector [Ministry of Agriculture and Forestry 2013]. For instance, one of those efforts is the establishment of a single family farm, community, and also large-scale irrigation systems. Despite the fact that the irrigation and drainage systems in Lao PDR, i.e. irrigation and drainage canals, head works, etc. already exist, however, the efficiency of water allocation and water supply for service areas is still somewhat doubtful as its system becomes deteriorated [PHONEMANY, KUNTIYAWICHAI 2016]. That is to say, the system still needs to be upgraded and maintained annually and substantially, so that the issues of low productivity, inadequate water supply, and expensive production cost can be avoided [SIVANGPHENG *et al.* 2014]. In this regard, this study aims to focus on the irrigation systems of Bokeo Province, Lao PDR, where it is known as a problematic area for irrigation

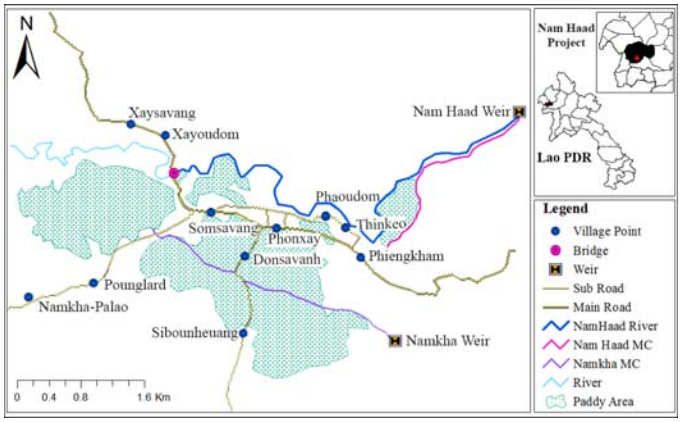

Fig. 1. Map of the Nam Haad Left Irrigation Project; source: own elaboration

water management nowadays. A careful consideration of farmer practices for the sustainability of the community-based irrigation water management systems was also taken into account for this study.

It is well recognized that the involvement of farmers in managing irrigation water distribution can induce the increase in farm productivity and the improvement of irrigation systems [GROENFELDT, SUN 2016]. In addition, the farmers also need to be encouraged to join the Water User Group (WUG) for participatory management of irrigation water and its systems in their respective areas [ALAN 2016]. As can be learnt from the case of Taiwan, the water is allocated based on irrigation plans and it is managed by water-guards who are local farmers of the respective community [LAM 1996]. The irrigation water management systems can also be transferred from the state to users (i.e. WUAs and farmer unions) as suggested by the findings from the case of Turkey [YERCAN 2003]. Moreover, the irrigation water management systems can also be managed in association with the Water Framework Directive [MIODUSZEWSKI 2006]. Besides the important role of farmers in improving irrigation systems, there are several approaches that have been established in the past, e.g. the formulation of agro-climatic zoning strategy [NORELDIN *et al*. 2016], the use of soil moisture sensor technology [CEPUDER, NOLZ 2007], etc. In relation to the evaluation of community engagement in irrigation water management and level of ownership of farmers, this study would be very useful to provide the understanding and knowledge in managing the community-based irrigation water management systems, especially in Phaoudom District, Bokeo Province, Lao PDR.

MATERIALS AND METHODS

STUDY AREA

This study focused on the Nam Haad Left Irrigation Project (NHLIP), situated in Phaoudom District, Bokeo Province, Northwestern of Lao PDR (Fig. 1). In details, Phaoudom District has a total area of approximately 1,579 km^2, with the population estimated to be about 36,400 people in 2015. In the study area, the Nam Haad River is known as the major river with about 7 km in length, which is used to supply water for irrigation and livelihood. In Phaoudom District, there are two main canals (MC), i.e. Nam Haad MC 2.07 km and Namkha MC 3.36 km. In view of meteorological situation, during the period of 2001 to 2009, Phaoudom District has a warm temperature climate in which the dry season is from November to February while the wet season is from May to October. The mean daily temperature was estimated to be 21°C, while the minimum temperature was recorded to be 13.5°C in January 2009 and the maximum temperature reached 35.1°C in April 2001. The mean annual rainfall was estimated to be approximately 1,846 mm with the highest monthly rainfall of 652.9 mm in July 2008. The average relative humidity at Bokeo meteorological station was found to be from 25% to 76% (between March and July) and from 82% to 97% (between March and September). The mean annual evaporation was observed to be 1,601 mm·year^{-1} with the minimum evaporation of 68.2 mm·month^{-1} recorded in May 2001 and the maximum of 257 mm·month^{-1} recorded in March 2004 [ADB 2015]. According to the MAF, the NHLIP's beneficiaries were estimated to be about 1,116 households with a total population of 4,311 people in 2013, as shown the details in Table 1 (note: all beneficiaries were from 11 villages, i.e. Phaoudom, Thinkeo, Phonxay, Pounglard, Sibounheuang, Phiengkham, Xaysavang, Namkha-Palao, Somsavang, Xayoudom, and Donsavanh).

Table 1. General information and beneficiary of villages in Phaoudom District

Village	General information		Beneficiary	
	household	population	household	population
Phaoudom	216	1 133	73	385
Phonxay	151	853	52	336
Phiengkham	95	557	443	278
Thinkeo	166	939	96	592
Pounglard	135	704	63	329
Sibounheuang	82	435	65	359
Xaysavang	51	251	34	178
Namkha-Palao	112	644	77	470
Somsavang	150	854	63	382
Xayoudom	160	1 072	101	707
Donsavanh	63	358	49	295
Total	1 381	7 800	1 116	4 311

Note: beneficiary group is indicated only in the irrigated area.
Source: own study.

DATA ANALYSIS

The data for this study was collected at Phaoudom District from questionnaire survey and in-depth interview using Key Information Interview (KII) method, which was undertaken in Lao language in

2016. The KII approach was used to identify the experts who are able to corporate and lead the NHLIP project for effective irrigation water management system. To analyse the obtained survey data, the Statistical Package for Social Sciences (SPSS) which is a widely used program for statistical analysis and handling complex data manipulations and analyses, was used.

The surveying was conducted by selecting a random number of respondents in the study area. The number of respondents was calculated by using Taro Yamane formula as presented in Equation 1, with a 90% confidence level and a sampling error tolerance level of 10%.

$$n = \frac{N}{1 + (N \cdot e^2)} \tag{1}$$

where: n = sample size; N = total population; e = level of precision at 90% confidence interval.

Among all sample sizes, there were 9 respondents to be selected as the key informants of this study. The selected key informants comprised some of the officials from the NHLIP project, i.e. 2 chiefs, 4 deputy chiefs, 2 accountants of the water user group, and 1 chief of the rice seed group. They were selected because of their abilities and direct involvement to the project. They were interviewed individually at their convenient time (note: during the period of data collection at either indoor or outdoor of their workplaces). The interviewing process was conducted based upon the KII guide question that best fits the research objectives and the contents of survey questionnaires. Furthermore, the classification of participation level of respondents was given on a discrete scale, the so-called "Likert scale", which is the most widely used method to scale responses in survey research (Tab. 2).

Table 2. Rating scale as classified by Likert scale

Score	Rating
4.20–5.00	very high
3.40–4.19	high
2.60–3.39	moderate
1.80–2.59	low
1.00–1.79	very low

Source: own study.

To determine the participation level of farmers in this study, as refers to [DYMERSKA *et al.* 2012; MIRDAMADI *et al*. 2016; SIVANGPHENG *et al*. 2014], the stepwise multiple regression analysis was used based on the given activities as shown in Equation 2.

$$Y = B_1x_1 + B_2x_2 + B_3x_3 + \ldots + B_nx_n + a \tag{2}$$

where: Y = the score of participation in irrigation system; B_1, …, B_n = the coefficient of correlation between the control variable (based on a 5-point Likert scale) and predicted variable; x_1, … x_n = the study activity variables; a = a constant variable.

RESULTS AND DISCUSSION

By using Taro Yamane formula, Equation 3 shows the calculation of number of respondents to be interviewed in Phaoudom Village and it was found to be approximately 68.

$$n = \frac{N}{1 + (N \cdot e^2)} = \frac{216}{1 + (216 \cdot 0.10^2)} = 68.35 \tag{3}$$

However, it should be noted that some respondents might not respond or answer the questions being asked and this can lead to unrepresentative and biased results. To compensate this possible shortcoming, the sample size should be increased by 10%. Therefore, the proposed/actual sample size (n) should be equal to 68.35 + (68.35·10%) = 75.19 or 75 (note: 9 respondents were selected as the key informants whereas 66 respondents were interviewed as supporting informants).

In details, respondents were asked to respond to a statement in one of five response categories that range from "very high" to "very low". At the household level, based on the experience and knowledge of the respondents, there are 12 practical activities that the respondents contribute to the Nam Haad Left Irrigation Project (NHLIP), such as: (1) and (2) opening and closing the secondary canal gates in their own rice field, respectively; (3) repairing the irrigation canals; (4) maintaining the irrigation canals; (5) attending the meetings related to operation and management of irrigation system; (6) updating the knowledge on operation and management of irrigation system by listening to the radio; (7) updating the knowledge by reading leaflets; (8) updating the knowledge by reading books; (9) updating the knowledge by discussing with the household members; (10) taking note and discussing problems related to the irrigation project; (11) taking note and discussing the positive impacts (strengths) of the irrigation project; and (12) discussing with the entire family on the issues related to the irrigation project.

In this study, the Statistical Package for Social Sciences (SPSS) program was used for handling the survey data. The results illustrated in Figure 2 reveal that rice farming is mainly a husband-wife partnership

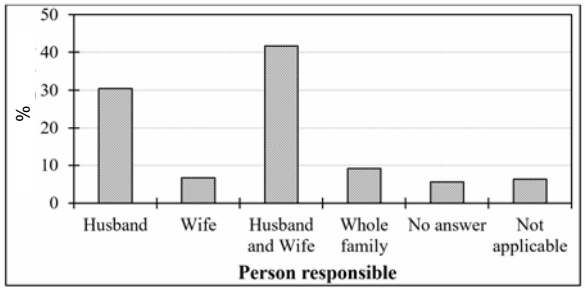

Fig. 2. Percentage of household participation in irrigation water management in the Nam Haad Left Irrigation Project; source: own study

Table 3. Household participation in irrigation water management in the Nam Haad Left Irrigation Project

Activity	Responsible person						
	husband	wife	husband and wife	whole family	no answer	not applicable	total
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	∑*n* (%)
Opening the gate(s)	43 (65.2)	–	16 (24.2)	4 (6.1)	3 (4.5)	–	66 (100)
Closing the gate(s)	32 (48.5)	–	22 (33.3)	9 (13.6)	3 (4.5)	–	66 (100)
Repairing the irrigation canals	22 (33.3)	–	21 (31.8)	21 (31.8)	2 (3.0)	–	66 (100)
Maintaining the irrigation canals	11 (16.7)	–	38 (57.6)	15 (22.7)	2 (3.0)	–	66 (100)
Attending meetings	26 (39.4)	2 (3.0)	34 (51.5)	2 (3.0)	2 (3.0)	–	66 (100)
Updating knowledge by listening to the radio	19 (28.8)	1 (1.5)	29 (43.9)	9 (13.6)	4 (6.1)	4 (6.1)	66 (100)
Updating knowledge by reading leaflets	14 (21.2)	6 (9.1)	30 (45.5)	2 (3.0)	9 (13.6)	5 (7.6)	66 (100)
Updating knowledge by reading books	17 (25.8)	14 (21.2)	24 (36.4)	1 (1.5)	5 (7.6)	–	66 (100)
Updating knowledge by discussing with the household members	11 (16.7)	–	47 (71.2)	–	5 (7.6)	2 (3.0)	66 (100)
Taking note and discussing problems related to the project	20 (30.3)	14 (21.2)	26 (39.4)	1 (1.5)	5 (7.6)	–	66 (100)
Taking note and discussing positive impacts/ strengths of the project	19 (28.8)	–	37 (56.1)	1 (1.5)	5 (7.6)	–	66 (100)
Discussing among the entire family members	14 (21.2)	1 (1.5)	45 (68.2)	1 (1.5)	5 (7.6)	–	66 (100)

Explanation: *n* (%) = the number of respondents and its percentage compared to the total number of respondents.
Source: own study.

(about 42% of the total respondents) in irrigation water management in the NHLIP.

As presented in Table 3, there are about 65.2% of respondents answered that the husband is the primary manpower for gate opening to supply the irrigation water to their own rice fields, whereas about 48.5% involves with gate closing. About the repairing of irrigation canals, the results suggested that almost all respondents agreed with the mutual responsibility for this particular task (note: 33.3%, 31.8%, and 31.8% of respondents answered that it should be under the responsibility of husband, husband and wife, and the whole family, respectively). The majority of respondents (57.6%) indicated that the maintenance of irrigation canals should be the role for both husband and wife. Likewise, approximately 51.5% of respondents prioritized the primary importance of attending meetings related to proper operation and management of irrigation system for both husband and wife. Moreover, with the development of a wide variety of media technology and other media devices, both husband and wife will have more access to gain more knowledge on the expansion of their irrigation system by listening to the radio programs, reading leaflets and books, taking a note, and discussing about the irrigation project among the entire family members.

It is a crucial fact that conducting an effective interview is a critical element for determining farmers' levels of participation in irrigation water management of the NHLIP. The following four phases, which serve to ensure the purpose and direction of the interview and also help to define the desired outcomes/ benefits over the long-term sustainable and cost-effective way, can be presented as follows.

- **Phase 1.** Setting the stage starts with introductions and takes place before an agenda is set. In details, this phase involved the invitation of farmers who are engaged with the irrigation water management of the NHLIP to have a **discussion about the project vision, mission, and goals (x_1)**. Next, a constructive environment for dialogue was created by allowing the **farmers to get to know each other (x_2)**. During the meeting, a **determination of initial leadership and organizational management** was carried out to ensure that a leadership or management core team is in place **(x_3)**. Thereafter, the **purpose and process of the project was outlined and discussed** with the help of facilitator **(x_4)**. This phase ended up with the **determination of interest** for further discussions and setting up for phase 2 **(x_5)**.
- **Phase 2.** Gathering information intends to identify relevant issues that need to be addressed for the following in-depth investigation. Firstly, an **appropriate and encouraging environment** was established for asking questions, expressing hesitation/doubts, and brainstorming and sharing new ideas **(x_6)**. Then, the **relevant and necessary information was gathered** through SWOT analysis in which the farmers discussed the NHLIP project's (internal) strengths and weaknesses, as well as (external) opportunities and threats influencing the management of irrigation water of the NHLIP, in conjunction with the other tools such as Appreciative Inquiry (AI), asset mapping, etc. **(x_7)**. The issues related to **community's values, ethics, vision, and mission were also clarified**, together with the establishment of the common ground for increased collaboration (before start discussing) **(x_8)**. After that, the **alternative solutions were derived** from "what if" questions (through brainstorming, critical thinking, and discussion), which covered the options, the alignment with the vision, and the potential impacts **(x_9)**. The **selection of the best practice/solution** was made accordingly (note: too many choices lead to confusion) **(x_{10})**. Eventually, the decision was made based on the **farmer's readiness** to move to phase 3 **(x_{11})**.

- **Phase 3.** Planning and reviewing is an important process as every review leads to a plan and every plan needs to be reviewed. This phase involves the identification of what has to be done, by whom, at what cost and when. In brief, phase 3 started with **drafting the implementation action plan** based on the inputs from the planning teams (from each topic area), including its evaluation procedures. The identification of costs, involved and responsible persons, timeline setting, progress-monitoring measures, and action status, were also considered **(x_{12})**. Later, the **proposed implementation action plan was discussed** with the involved farmers/communities for insight and decision making purposes **(x_{13})**. The **proposed implementation action plan was reviewed, assessed, and revised** accordingly based on the feedbacks received from involved members **(x_{14})**. At last, the decision was made based on the **farmer's readiness** to move to phase 4 **(x_{15})**.
- **Phase 4.** Implementation, monitoring, and evaluation provides a series of strategies and guidelines for implementing the project. In particular, the negotiation and **finalization of funding agreements was conducted** with the oversight committees **(x_{16})**. **Identification/naming of staffs and members for the management team** was also made by promoting key persons who have leadership potential and demonstrated readiness for greater responsibilities from different divisions and various backgrounds **(x_{17})**. Next, the **implement of the plan was undertaken** by ensuring that the members distribute the power, offer recognition, communicate among each other, and respect the roles of the members (note: certainly, the success can be assured if the implementation of the action plan is expected to be effective in case it operates with good governance and a focus on financial sustainability, risk management, and legislative compliance) **(x_{18})**. The **project progress and performance was then monitored** to identify variation from the plan and recommend preventive and corrective actions to ensure the delivery of the project in line with the planned expectations **(x_{19})**. After that, the **current status and project impacts were noted and evaluated** based on feedbacks gathered from farmers/communities **(x_{20})**. Finally, the **implementation plan was re-evaluated and revised** based on the actual impacts and the farmer/community feedbacks (note: this step may involve any of the previous steps) **(x_{21})**.

Based on the survey data and Likert scale, the respondents' responses on farmers' levels of participation in irrigation water management of the NHLIP was analysed and classified into five levels, i.e. very high (5), high (4), moderate (3), low (2), and very low (1). As can be seen in Table 4, the respondents possessed a "**high**" level of involvement in irrigation water management of the NHLIP. This is clearly shown by the score for each statement of each phase that falls between 3.40 and 4.19 and also the overall mean score of 3.80 on 1–5 Likert scale (note: the mean score was calculated using SPSS software by summing the ratings of all the respondents and dividing that sum by the number of respondents). Besides that, a column for "Not applicable" was also included to record the percentage of respondents who are not able to respond to a statement in survey questions and also to assess respondents' level of comprehension. In details, by considering phase 1 to phase 4, it was found that most of the respondents engaged with a high participation level in all irrigation water management activities in the NHLIP (i.e. around 51.0% to 63.7% of the total number of respondents) as indicated in Figure 3.

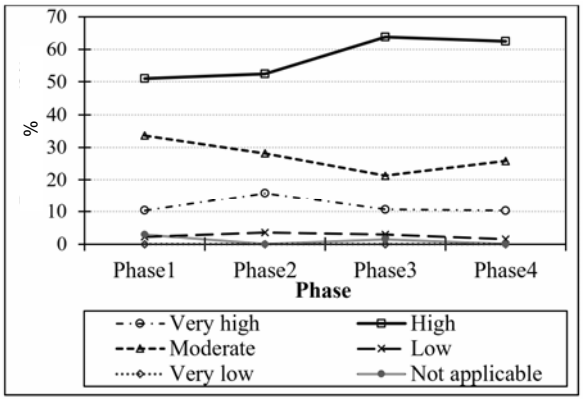

Fig. 3. Percentage of respondents engaged with different participation levels for each phase of irrigation water management activities in the Nam Haad Left Irrigation Project; own study

Although this study was successfully undertaken for certain issues, there are still some challenges that urge farmers and farmer leaders to reconsider in the future such as: (1) time constraint in discussing problems among farmers and farmer leaders, (2) difference in understanding of farmers related to "problem-focused thinking" and "solution-focused thinking", and (3) the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis and other assessment tools such as Appreciative Inquiry (AI), asset mapping, etc. are not yet familiar for the farmers at this moment.

To evaluate the significance of each activity on farmers' levels of participation in irrigation water management of the NHLIP, the determination coefficient (R^2) and the independent samples *t*-test were used to explain the goodness-of-fit and to compare the mean difference between predictors and control variables, respectively. Moreover, the Durbin–Watson statistic test was also used to describe the autocorrelation in the residuals from a statistical regression analysis. The values of Durbin–Watson statistic range between 0 and 4, in which 0 represents positive autocorrelation and 4 represents negative autocorrelation. From the results of stepwise multiple regression analysis, various activities related to meeting on project vision,

Table 4. Respondents' responses on farmers' levels of participation in irrigation water management of the Nam Haad Left Irrigation Project

Statement	Response							Mean	Level of participation
	very high	high	moderate	low	very low	not applicable	total		
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	∑*n* (%)		
Phase 1 – setting the stage									
Meeting on project vision, mission, and goals (x_1)	8 (12.1)	46 (69.7)	10 (15.2)	–	–	2 (3.0)	66 (100)	3.85	high
Getting to know the other members of the group (x_2)	11 (16.7)	26 (39.4)	28 (42.2)	1 (1.5)	–	–	66 (100)	3.71	high
Forming the core group of leaders (x_3)	6 (9.1)	34 (51.5)	24 (36.4)	2 (3.0)	–	–	66 (100)	3.67	high
Defining and discussing on the project (x_4)	4 (6.1)	33 (50.0)	28 (42.4)	1 (1.5)	–	–	66 (100)	3.61	high
Measuring the interest of the members on the project (x_5)	6 (9.1)	34 (51.5)	24 (36.4)	2 (3.0)	–	–	66 (100)	3.67	high
Phase 2 – gathering information									
Open discussion for asking questions, expressing hesitation, and sharing new ideas (x_6)	8 (12.1)	37 (56.1)	19 (28.8)	2 (3.0)	–	–	66 (100)	3.77	high
Gathering information using SWOT analysis and other tools (x_7)	8 (12.1)	29 (43.9)	25 (37.9)	4 (6.1)	–	–	66 (100)	3.62	high
Clarifying the alignment of issues with the community's values, ethics, vision, and mission (x_8)	17 (25.8)	33 (50.0)	14 (21.2)	2 (3.0)	–	–	66 (100)	3.98	high
Asking alternative solutions ("what if" questions) (x_9)	14 (21.2)	31 (47.0)	19 (28.8)	2 (3.0)	–	–	66 (100)	3.86	high
Selecting the best solution (x_{10})	6 (9.1)	34 (51.5)	24 (36.4)	2 (3.0)	–	–	66 (100)	3.67	high
Farmer leaders' determination if the members are ready to move to the next phase (x_{11})	10 (15.2)	45 (68.2)	11 (16.7)	–	–	–	66 (100)	3.98	high
Phase 3 – planning and reviewing									
Writing the implementation plan (x_{12})	6 (9.1)	37 (56.1)	23 (34.8)	–	–	–	66 (100)	3.74	high
Discussion with the members/ community on the implementation plan (x_{13})	6 (9.1)	42 (63.6)	18 (27.3)	–	–	–	66 (100)	3.82	high
Revision of the implementation plan based on feedbacks received from the members (x_{14})	7 (10.6)	46 (69.7)	12 (18.2)	–	–	1 (1.5)	66 (100)	3.92	high
Farmer leaders' determination if the members are ready to move to the next phase (x_{15})	10 (15.2)	49 (74.2)	5 (7.6)	2 (3.0)	–	–	66 (100)	4.02	high
Phase 4 – Implementation, monitoring, and evaluation									
Finalization of funding (x_{16})	11 (16.7)	34 (51.5)	21 (31.8)	–	–	–	66 (100)	3.85	high
Identification/naming of staffs and members for the management team (x_{17})	8 (12.1)	45 (68.2)	13 (19.7)	–	–	–	66 (100)	3.92	high
Implementation of the plan (x_{18})	12 (18.2)	43 (65.2)	10 (15.2)	1 (1.5)	–	–	66 (100)	4.00	high
Monitoring the project progress (x_{19})	4 (6.1)	49 (74.2)	12 (18.2)	1 (1.5)	–	–	66 (100)	3.85	high
Noting and evaluating the project impacts (x_{20})	3 (4.5)	33 (50.0)	29 (43.9)	1 (1.5)	–	–	66 (100)	3.58	high
Revision and re-evaluation of implementation plan based on the actual impacts and the community feedbacks (x_{21})	3 (4.5)	45 (68.2)	18 (27.3)	–	–	–	66 (100)	3.77	high
Overall mean score								3.80	high

Explanation: *n* (%) = the number of respondents and its percentage compared to the total number of respondents.
Source: own study.

mission, and goals (x_1) (phase 1); clarifying the alignment of issues with the community's values, ethics, vision, and mission (x_8) (phase 2); revision of the implementation plan based on feedbacks received from the members (x_{14}) (phase 3); and implementation of the plan (x_{18}) (phase 4), show a great significance level as it has significant correlation with all control variables (i.e. $R^2 > 0.78$) with the statistical significance at 0.05 (p-value < 0.05) as shown more details in Table 5 and Table 6, respectively.

From the above regression output, a standardized regression equation in Equation 4 was established to

Table 5. Correlations between the predictors and control variables

Activity	Phase	R^2	Standard error of the estimate	Value of Durbin-Watson statistic
Meeting on project vision, mission, and goals (x_1)	1	0.79	7.76	1.34
Clarifying the alignment of issues with the community's values, ethics, vision, and mission (x_8)	2	0.97	3.14	2.84
Revision of the implementation plan based on feedbacks received from the members (x_{14})	3	0.78	7.98	1.26
Implementation of the plan (x_{18})	4	0.87	6.19	1.62

Source: own study.

Table 6. The analysis results of predictors by stepwise multiple regression analysis

Activity	Unstandardized coefficient		Standardized coefficient β	t-test	p-value
	B	standard error			
Meeting on project vision, mission, and goals (x_1)	0.538	0.134	0.918	4.012	0.028
Clarifying the alignment of issues with the community's values, ethics, vision, and mission (x_8)	0.831	0.078	0.987	10.677	0.002
Revision of the implementation plan based on feedbacks received from the members (x_{14})	0.534	0.138	0.913	3.883	0.030
Implementation of the plan (x_{18})	0.607	0.117	0.949	5.200	0.014

Note: constant value a is 7.572 and p-value is two-tailed significance level of t.
Source: own study.

determine the scores representing the participation levels in irrigation water management in the NHLIP.

$$Y = 0.538x_1 + 0.831x_8 + 0.534x_{14} + 0.607x_{18} + 7.572 \quad (4)$$

CONCLUSION

The assessment of the community engagement in irrigation water management in the Nam Haad Left Irrigation Project (NHLIP) was carried out in this study. The Statistical Package for Social Sciences (SPSS) was used for survey data processing and analysis. Based on the outcomes of this study, the results proved that most of the respondents are truly engaged with a high level of participation in the management of irrigation water of the NHLIP project as indicated by a high score of 3.80 on the five-point Likert scale. In addition, a standardized regression equation was established as follows: $Y = 0.538x_1 + 0.831x_8 + 0.534x_{14} + 0.607x_{18} + 7.572$, for determining the participation levels in irrigation water management in the NHLIP. The results also showed that engaging the partnerships between farmers and farmer-leaders, and household and community levels can be very helpful for the future management, operation, and maintenance of the NHLIP project. The main findings obtained from this study can also be very useful for irrigation water management practices in Bokeo Province and other areas in Lao PDR.

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Zaangażowanie społeczności w zarządzanie nawodnieniami w Laotańskiej Republice Ludowo-Demokratycznej

STRESZCZENIE

Dla bezpieczeństwa wodnego istotne są zrównoważone zarządzanie zasobami wody i zaangażowanie społeczeństwa. W badaniach prezentowanych w niniejszej pracy dokonano oceny zaangażowania społeczności w zarządzanie nawodnieniami w ramach projektu Nam Haad Left Irrigation Project (NHLIP). Szczegółowo rozważano praktyki na poziomie gospodarstwa domowego i społeczności lokalnej oraz poziom uczestnictwa rolników w zarządzaniu nawodnieniami. Wyniki uzyskane z odpowiedzi respondentów wskazują, że znaczący udział w gospodarowaniu wodą do nawodnień upraw ryżu w ramach projektu mają mąż i żona. Wyniki świadczą również, że większość respondentów uczestniczy z dużym zaangażowaniem w projekcie, czego dowodem jest wysoka punktacja (3,80) w pięciostopniowej skali Likerta. Do określenia istotności każdego rodzaju aktywności i udziału rolnika w zarządzanie nawodnieniami w ramach projektu NHLIP zastosowano krokową regresję wieloraką, a standaryzowane równanie regresji opisujące poziom całkowitego zaangażowania ma postać: $Y = 0{,}538x_1 + 0{,}831x_8 + 0{,}534x_{14} + 0{,}607x_{18} + 7{,}572$. Podsumowując, wyniki badań wskazują chęć udziału i współpracy w ulepszaniu i zarządzaniu projektem NHLIP.

Słowa kluczowe: *grupa użytkowników wody, krokowa regresja wieloraka, Statystyczny Pakiet dla Nauk Społecznych, zaangażowanie społeczności, zarządzanie nawodnieniami*